

Demography Working Paper 99/3

SERVICE POPULATION PILOT STUDY

**An Investigation to Assess the Feasibility of
Producing Service Population Estimates for Selected
LGAs**

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TABLE OF CONTENTS

page no.

Table of Contents	
List of Tables	
List of Abbreviations	
Executive Summary.....	1
1. Introduction.....	3
1.1 Background.....	3
1.2 Aims of the Study.....	3
1.3 Possible Outcomes.....	4
1.4 User Advisory Group.....	4
2. Project Parameters.....	4
2.1 Temporary Residents.....	4
2.2 Day Visitors.....	5
2.3 'Average' or 'Peak' Service Population.....	5
2.4 The Study Areas.....	6
3. Methodology.....	7
3.1 Previous Research.....	7
3.2 Generic Indicators.....	7
3.2.1 Criteria Used to Assess the Indicators.....	8
3.2.2 Summary Evaluation of the Indicators.....	11
3.2.3 Generic Indicators: Some Conclusions.....	13
3.3 Estimating Components of the Service Population.....	14
3.3.1 An Overview of Data Sources.....	14
3.3.2 Estimating Components: Some Conclusions.....	21
4. Outcomes.....	21
4.1 Major Findings.....	21
4.2 Possible Areas of Future Investigation.....	22
4.3 Summary of Findings.....	23

References.....	24
Appendix A: Data Sources.....	25
Appendix B: Estimating Components of Service Populations - Case Studies.....	26
Appendix C: Estimating 'Capacity Populations' in Tourist Destinations.....	32
Appendix D: Estimating Average Number of Overnight Visitors in Tourist Destinations.....	34
Appendix E: The ABS Business Register.....	35
Appendix F: When ERPs Aren't Enough - a discussion of issues associated with service population estimation (Executive Summary), Cook, T, Australian Bureau of Statistics Demography Working Paper 96/4.....	37

LIST OF TABLES

METHODOLOGY	1: Consumption Indicators.....	12
	2. Waste Production Indicators.....	13
APPENDIX B	3. Shire of Wiluna: Selected Characteristics.....	26
	4. Average Number of Employees, Wiluna Mines, 1996-98.....	27
	5. Perth City Tourist Accommodation: Selected Characteristics..	29
	6. Workforce of Perth City: Place of Usual Residence.....	30

LIST OF ABBREVIATIONS

ABS - Australian Bureau of Statistics
ATO - Australian Taxation Office
BTR - Bureau of Tourism Research
DCAT - Department of Commerce and Trade
DOME - Department of Minerals and Energy
DRD - Department of Resource Development
ERP - Estimated Resident Population
EPA - Environmental Protection Authority
HBI - Hot Briquette Iron
LGA - Local Government Authority
NOLG - National Office of Local Government
SLA - Statistical Local Area
STA - Survey of Tourist Accommodation
UAG - User Advisory Group
VGO - Valuer-General's Office
WALGGC - Western Australian Local Government Grants Commission
WAMA - Western Australian Municipal Association
WATC - Western Australian Tourism Commission
WATS - Western Australian Travel Survey

EXECUTIVE SUMMARY

1. Background

This paper reports on the outcomes of a pilot study undertaken by the Australian Bureau of Statistics (ABS), on behalf of the National Office of Local Government (NOLG), to investigate the feasibility of producing estimates for specified service populations.

The study was commissioned as a result of concerns expressed by a number of Local Government Authorities (LGAs) across Australia that funding based on estimates of resident populations (ERPs), as currently prepared by the ABS, does not take adequate account of tourists, fly-in/fly-out workers and other non-usual residents who use services provided by those LGAs.

'Service population' is therefore used in this paper to refer to all persons who access services and facilities generally provided by the LGA. Such persons may be permanent or temporary residents of the area from which the service is sought, or they may be daytime visitors (including commuters), overnight or short term visitors to the area.

The study assessed a range of existing data sources in terms of their applicability and availability for service population estimation for five LGAs in Western Australia: City of Perth, Shire of Busselton, Town of Port Hedland, Shire of Wiluna and Shire of Gingin.

2. Methodology

In the course of this study over thirty data sources in total were investigated (Appendix A).

On the premise that a rise or fall in the total number of persons serviced by a given LGA would create a corresponding rise or fall in certain indicators within that LGA, a number of 'generic' indicators were identified. These fell into two main categories:

- *indicators of household or personal consumption*: including water, electricity, gas, telephone and automatic telling machine usage and retail sales of petrol, milk, bread, newspapers, cigarettes, alcohol and Coca Cola (selected as the highest volume selling product in some large supermarkets);
- *indicators of waste production*: including wastewater (or sewage) flows and volumes of refuse disposed of at the landfill site.

Each indicator was assessed against 10 criteria, six of which were regarded as essential for producing reliable service population estimates for the five LGAs. The most common deficiencies in the indicators were lack of applicability to some LGAs, incomplete coverage of the dataset, difficulties in accessing or extracting the data from sources not designed for the purpose, data not available at the appropriate geographic level and the impact of environmental variables on consumption patterns.

Some data sources were also assessed in terms of their ability to produce reliable estimates for particular components of the service population such as tourists, fly-in/fly-out workers and commuters.

3. Outcomes

The outcomes from this feasibility study may be summarised as follows:

1. Although much information is currently held by State government and other agencies which could assist in the measurement of service populations, the study failed to identify any indicators which could be used successfully to estimate a total service population for all five LGAs.
2. Pending further investigation of data held by the relevant State agencies, the measurement of refuse and wastewater flows may be useful in producing estimates for a limited number of LGAs. The measurement of milk consumption might also prove useful although, due to the multiplicity of data sources, this would present more difficulties for those wishing to acquire the data.
3. Some data sources were identified which, subject to the acceptance of certain explicit assumptions by major stakeholders, could be used to produce estimates for a particular component of a total service population, e.g. tourists and commuters in the City of Perth and fly-in/fly-out workers in the isolated mining community of Wiluna.
4. There appears to be some scope to develop estimates of the 'maximum carrying capacity' of certain (mainly southern) LGAs with large tourist populations. 'Maximum carrying capacity' here refers to the total number of persons (excluding day visitors) that can be accommodated in the LGA if all private dwellings and beds in commercial accommodation establishments are fully occupied. For these LGAs, there is also some scope to develop estimates of the average number of overnight visitors within a specified period.
5. In the future, responsibility for LGA service populations may rest with Local Government Grants Commissions in liaison with the LGAs for which they provide funding. This would require an agreement between State and local governments specifying the data to be used in service population estimation and the steps to be taken in ensuring these data are appropriate, reliable and consistently applied to all LGAs with a similar population profile. The ABS would be willing to assist with this process.

1. INTRODUCTION

1.1 Background

This paper reports on the outcomes of a pilot study undertaken by the Australian Bureau of Statistics (ABS), on behalf of the National Office of Local Government (NOLG), to investigate the feasibility of producing estimates for specified service populations.

The study was commissioned as a result of concerns expressed by a number of Local Government Authorities (LGAs) across Australia that funding based on estimates of resident populations (ERPs), as currently prepared by the ABS, does not take adequate account of tourists, fly-in/fly-out workers and other non-usual residents who use services provided by those LGAs.

'Service population' is therefore used in this paper to refer to all persons who access services and facilities generally provided by the LGA. Such persons may be permanent or temporary residents of the area from which the service is sought, or they may be daytime visitors (including commuters), overnight or short-term visitors to the area.

Service populations, by definition, are not discrete. Individuals may belong to many different service populations, associated with LGAs which may be spatially contiguous or some distance apart. It is, therefore, not possible to produce estimates of service populations for larger regions (e.g. Statistical Divisions) by aggregating estimates for all their constituent LGAs. (In this respect, service population estimates are very different from ERPs which can be aggregated up to higher geographic levels.) The service population of any region can only be estimated in terms of the total number of persons accessing the services within its boundaries.

Demand for service population estimates at the LGA level was canvassed as part of the ABS's 1996 Review of Demographic Statistics (ABS, 1996a). Nearly 40% of agencies which responded to that review indicated that ERPs did not meet their population information needs as services were also provided to non-usual residents. Following that review, an ABS Demography Working Paper (Cook, 1997) outlined the main user needs as well as the conceptual, methodological and reporting load issues involved in estimating service populations. (The Executive Summary from that paper is reproduced in Appendix F.) The paper called for expressions of interest from organisations wishing to contribute to a pilot study which would use, for the most part, existing data sources and would investigate the feasibility of producing service population estimates which met user needs in relation to data quality, cost and timeliness considerations. The ABS indicated its willingness to assist with the production of service population estimates, if feasible, where the users were prepared to meet the cost involved and to take responsibility for the wide range of explicit and implicit assumptions required in producing these estimates.

Following discussions with NOLG, which agreed to provide some funding, the ABS subsequently undertook to conduct a pilot study in Western Australia.

1.2 Aims of the Study

The aims of the pilot study, outlined in the consultancy specifications, were to:

- investigate the feasibility of producing estimates for specified service populations;
- analyse various data sources with a view to assessing their applicability and availability for producing service population estimates;
- produce service population estimates for each of the selected LGAs;

- obtain comment on the estimates produced from interested clients including the Local Government Grants Commission and the Western Australian Municipal Association; and
- prepare a report on the study.

1.3 Possible Outcomes

The consultancy specifications recognised two possible outcomes for this pilot study:

It is not possible to produce service population estimates of an accuracy and consistency that would be acceptable to the Grants Commissions and the other bodies involved. In the event of such an outcome, it was expected that the reasons would be stated in the final report.

or

It is possible to produce satisfactory estimates, in which case the final report would give details of the estimates and how they were produced.

A third possibility emerged during the course of the study; that of producing satisfactory estimates of some components of the service population, such as fly in/fly out workers and commuters, in some selected LGAs.

1.4 User Advisory Group

A local User Advisory Group (UAG) was set up to examine the conceptual and methodological issues associated with the study and to provide more detailed direction on the work to be undertaken. The group included representatives from four State government agencies; the Department of Commerce and Trade (DCAT), the Ministry for Planning, the Local Government Grants Commission (WALGGC) and the Municipal Association (WAMA).

2. PROJECT PARAMETERS

As shown in the ABS Demography Working Paper (Cook, 1997), the term 'service population' means different things to different service providers. Such a population can include temporary residents and day visitors to an area, whether tourists or those commuting for work. The proposal for this pilot study specified that both temporary residents and day visitors should be included in any service population estimates that were produced.

2.1 Temporary Residents

According to the definition used in the 1996 Census of Population and Housing, "usual residence" is "that address at which the person has lived or intends to live for a total of 6 months or more in 1996" (ABS, 1996b). Following the Census definition, the 'usual resident population' of a specified LGA comprises those persons who, at a particular point in time (usually 30 June in the specified year), have lived, or intend to live, in that LGA for six months or more.

Temporary residents, therefore, are persons living in the LGA whose period of residence, or intended period of residence, is less than six months. These can include:

Short-term contract/ seasonal workers: for these workers, the period of residence may vary from an overnight stay, in the case of a truck driver or fruit picker, to several months in the case of a crayfisherman or construction worker. The families of these workers can also be included in the temporary resident population. However workers and their families who are resident for more than half the year should be included in the usual resident population

Fly-in/fly-out (or rotational) workers: these are persons who work at a particular site on a rotational basis eg. two weeks on, one week off. Such workers may be working for a contractor and, over a period of weeks or months, may work at various sites as required by the contractor. However, many fly-in/fly-out workers are employed within a single LGA and cumulatively spend more than six months in that LGA in the specified 12 month period; these workers do not meet the above definition of temporary residents and should be included in the usual resident population.

Transient Indigenous persons: in some remote areas of the State, these persons may contribute to substantial increases or decreases in the total service population at different times of the year and in accordance with Indigenous cultural requirements. In some Indigenous communities, the number of usual and temporary residents may be very difficult to determine.

Tourists and other visitors: this category includes all other visitors to an area who stay overnight in that area. In Western Australia most tourist areas exhibit pronounced tourism peaks, mainly in the south of the State in summer and in the north in winter.

2.2 Day Visitors

For the purposes of this study, two main groups of day visitors were recognised:

Commuters: that is, persons who travel to another LGA for work on a daily basis; and

Day 'tourists': this group includes 'local' tourists, that is, visitors from adjacent LGAs who travel to a major centre for shopping purposes, or to visit cultural or entertainment venues. It also includes tourists from further afield (including interstate and overseas visitors) who visit the area while travelling to another destination but do not stay overnight.

2.3 'Average' or 'Peak' Service Populations

In defining the parameters of this project, one critical issue which was discussed at an early meeting of the UAG was the relative merit of estimates based on the average service population in a specified period and estimates based on the maximum, or 'peak' service population in that period. It soon became apparent that requirements differed according to the type of user; for example, DCAT and a number of LGAs providing infrastructure and services to meet peak demands, had a greater interest in obtaining peak estimates whereas the WALGGC was more interested in obtaining an average figure.

The issue remains significant for LGAs which have significant service population variation as a result of seasonal tourism or employment.

2.4 The Study Areas

The study proposal identified five LGAs for investigation with differing characteristics, namely:

- Busselton* The Shire of Busselton is a South-West LGA with significant seasonal tourism. At 30 June 1998, its estimated resident population was 20,385 and its annual average rate of population growth (5.95%) over a two year period was one of the highest in the State (ABS, 1999). The Shire includes the coastal resorts of Yallingup, Dunsborough and the townsite of Busselton, 230 kilometres south of Perth. These resorts contain a large number of holiday homes, guest houses, caravan parks as well as larger commercial accommodation establishments. The Shire is also on the main route to the wine-growing areas of the South-West and other tourist destinations in the Augusta-Margaret River region.
- Wiluna* The Shire of Wiluna is a large remote LGA containing a single townsite, 950 kilometres to the North-East of Perth. At 30 June 1998, its estimated resident population was 1,127, representing a decrease of 2.76% since 30 June 1997 (ABS, 1999). The service population is dominated by mining workers. These are employed at four minesites, all of which operate on a fly in/ fly out basis (primarily on a two week on duty/one week off duty regime). The Shire also has a significant number of Indigenous people.
- Port Hedland* The Town of Port Hedland covers an area of almost 12,000 square kilometres and contains the port for mining operations in the Pilbara region. At 30 June 1998, its estimated resident population was 13,286 and its annual average rate of population growth over a two year period was 4.01% (ABS, 1999). Most of the population is concentrated around the port although the remaining rural area contains some pastoral leases and Indigenous communities. Port Hedland is an LGA for which journey to work information is available from the 1996 Census. After the Census, construction projects associated with the mining industry created a rapid increase in the temporary contract workforce, with up to 3,000 additional workers in the Town in 1998. Port Hedland's location on the only sealed road connecting the south of the State with the Kimberley region results in a significant number of tourists passing through the Town.
- Gingin* The Shire of Gingin is a rural LGA bordering the Perth Statistical Division, for which journey to work information is available from the 1996 Census. At 30 June 1998, its estimated resident population was 3,762 and its annual average rate of population growth over a two year period was 3.94% (ABS, 1999). The Shire is characterised by significant seasonal tourism which is mainly concentrated in the coastal villages of Lancelin, Ledge Point, Seabird and Guilderton. These villages are dominated by holiday homes and caravan parks. Their close location to Perth also makes them popular with daytrippers. The Shire attracts a number of hobby farmers and seasonal workers including crayfishermen and horticultural workers.
- Perth* The City of Perth, which includes the central business district, is the central LGA with the largest commuting population in Western Australia. Journey to work information from the 1996 Census is available for this LGA. At 30 June 1998, the estimated resident population of the City was 5,957 and its annual average rate of population growth over a two year period was 3.1% (ABS, 1999), reflecting the continuing trend towards inner city living. The LGA, which contains a number of large hotels, has a significant number of overnight tourists as well as commuters and daytrippers.

3. METHODOLOGY

3.1 Previous Research

While a number of studies have analysed temporary population movements in Australia (Bell and Ward, 1998a, 1998b, 1998c, 1999; Cook, 1998), using 1991 and 1996 Census data, the development of a rigorous methodology for estimating service populations remains largely unaddressed in the research literature.

At the commencement of this study, the central statistical agencies in Canada and the United Kingdom were approached, to ascertain what techniques, if any, had been used, or considered, for deriving service population estimates at the local government level.

In response to this request for information, Statistics Canada indicated that the issue of service population estimation could become a problem that the agency would have to address in the near future. A request from the province of Nova Scotia had been received to study the feasibility of adjusting resident population estimates to account for the out-of-province students, the Canadian Census practice being to enumerate university and college students at their parents' residence regardless of their physical location on Census night. While Statistics Canada does not propose to change its 2001 Census procedures, it may decide to adjust Census population estimates for out-of-province students depending on the results of the proposed feasibility study. However, at the time this information was received by the ABS (late 1998), it was not known when the feasibility study would be undertaken. Statistics Canada indicated its interest in the results of any research undertaken in Australia.

The central statistical agency in the United Kingdom indicated they had received some criticism from local authorities regarding the validity of resident population estimates, although the more common complaint in that country seemed to be that the estimates were generally too high. The agency's response to such criticism is that it can readily justify the methods used to estimate resident populations. While acknowledging the need to separately identify and annually enumerate some population groups (notably armed forces personnel, prisoners and boarding school pupils), the agency did not identify a widespread need for service population estimates.

To date, overseas statistical agencies have not been able to provide any assistance or advice on possible methods for deriving service population estimates,

3.2 Generic Indicators

In the absence of any known prior studies, either in Australia or overseas, the initial focus of this pilot study was to identify 'generic' indicators of service population size which could be measured at the LGA level in all, or most, jurisdictions within Australia. In the course of the study, a large number of ABS and other data sources were investigated (Appendix A).

Indicators were selected for investigation on the initial assumption that a rise or fall in the total number of persons serviced by a given LGA would create a corresponding rise or fall in the indicator for that LGA. Thus it was envisaged that the indicators would be used to estimate the total service population (usual residents + temporary residents + day visitors) rather than individual components of that population.

Generic indicators fall into two main categories:

- *indicators of household or personal consumption*: including water, electricity, gas, telephone and automatic telling machine usage and retail sales of petrol, milk, bread, newspapers, cigarettes, alcohol and Coca Cola (selected as the highest volume selling product in larger supermarkets);
- *indicators of waste production*: including wastewater (or sewage) flows and volumes of refuse disposed of at the landfill site.

For any given indicator, the initial objective was to ascertain whether total consumption or production figures could be extracted, or derived, at the LGA level, preferably from a single data source. The output was required on an ongoing and frequent basis - at least quarterly but preferably monthly - commencing no later than August 1996. This would allow for comparison with benchmark data from the 1996 Census and for seasonal and other fluctuations in the service population to be identified.

In some cases the recognised single data source was a State agency such as the *Water Corporation* or *Western Power*, or a national organisation such as the *Australian Dairy Corporation*. In other cases, regional distributors, or even individual LGAs, had to be approached.

Commodities such as milk, for which average per capita consumption figures were available at the national, State or regional levels, were of particular interest as they presented the possibility of deriving service population estimates directly from total consumption figures. For commodities where per capita figures were not available, it was hypothesised that changes in the size of the service population might be calculated on a proportional basis using a population benchmark. In simple terms this would mean, for example, that a 20% increase in sales of a selected item could be interpreted as a 20% increase in the service population. If successful, this approach might be particularly appropriate to areas with considerable seasonal variation in the size of the service population.

3.2.1 Criteria Used to Assess the Indicators

The initial assumption was that the above indicators were all potentially useful in identifying trends and fluctuations in service population size. However, more stringent criteria were needed for assessing their usefulness in producing service population estimates. Ten criteria were considered, six of which came to be regarded as essential while four were merely desirable.

a) Essential Criteria

Failure to meet any one of the following six criteria resulted in the indicator being evaluated as not widely useful for estimating service populations at the present time. The six essential criteria are listed below although not in any priority order.

1. Applicability of the indicator to a range of LGAs (urban/rural; coastal/inland etc.)

To produce nationally consistent estimates of service populations, the ideal indicator would be applicable to all LGAs in Australia. Owing to the diversity of LGAs, in terms of location, urban/rural character, remoteness, climate and basic infrastructure, it was clear from the outset that few, if any, indicators would meet this ideal. As a basic minimum, therefore, it was thought necessary that the indicator should be applicable to a wide range of LGAs. These are represented by the five study areas which vary considerably in relation to the above characteristics.

Some of the indicators initially identified were reliant on infrastructure which was not present in all the study areas. The lack of automatic telling machines, reticulated domestic gas supply, deep sewerage or a weighbridge at the local landfill site, particularly in rural LGAs, resulted in a number of indicators failing to meet this criterion. However, the possibility that these indicators could be used to produce estimates for a more limited range of LGAs was not ruled out.

2. *Geographic level of the data*

To produce reliable LGA service population estimates, the indicator data must be available at the LGA level. Some indicators, such as telephone usage, electricity consumption and milk consumption, failed to meet this criterion. Telstra was not able to provide any data on telephone usage by LGA.

While data on electricity sales were available for the discrete areas of Port Hedland and Wiluna, data for the other three study areas were not available at the LGA level. These areas are part of larger Western Power 'districts' within the 'South West Integrated System'.

Although total and average milk consumption figures could be obtained from the Dairy Industry Authority of Western Australia for three broad regions within the State, this agency was not able to provide any data at the LGA level.

3. *Data frequency*

It was considered that the data should be available on (at least) a quarterly basis to allow measurement of seasonal fluctuations in the service population. This was especially relevant to tourist destinations such as the Shire of Busselton and the Shire of Gingin where the visitor population peaks significantly in the summer months. Several of the indicators investigated were able to meet this criterion.

4. *Data accessibility*

It was considered necessary that the data should be readily accessible to those interested in producing service population estimates. Although a large amount of information is collected by various organisations, it was found that many government agencies, as well as private organisations, have systems which do not allow them to extract the required data quickly and easily. Several organisations, including a number of leading supermarket chains, have indicated that information for small areas is difficult, costly or time consuming to extract while others, such as the Water Corporation, are additionally constrained by commercial-in-confidence considerations.

5. *Coverage of the data set*

The indicator data should cover all units of consumption (or production) within the LGA. Several indicators failed to meet this criterion because some households or commercial establishments used different service providers or provided for themselves. For example, the widespread use of bores and rainwater tanks in some regions of the State means water consumption data provided by the Water Corporation would be incomplete in many LGAs.

A similar problem exists in relation to the measurement of wastewater flows as not all households are connected to the sewerage system, even in areas which are deep sewerred. This is true of many country towns where the use of septic tanks is widespread.

Measurement of the total amount of refuse produced by the LGA may also be inaccurate if alternative waste management services (accessing different landfill sites) are used by commercial establishments. This may be more prevalent in inner city areas where large companies take responsibility for managing their own waste.

Although retail sales data for milk, bread, cigarettes and Coca-Cola may be obtained (usually at a cost) from certain supermarket chains, the multiplicity of sales outlets in most LGAs mitigates against

complete coverage of all units of consumption.

6. *Influence of locational/environmental factors on the data*

The ideal indicator would not be subject to rises and falls due to factors other than change in the number of persons accessing the service in question.

In practice, most generic indicators investigated appeared to be subject to some locational or environmental influences. For example, the amount of household refuse produced by the LGA, while relatively simple to collect, is likely to be affected by active recycling policies in some LGAs. Wastewater flows, on the other hand, may be less susceptible to environmental factors of this kind.

Power and water consumption failed this criterion on the grounds that they were subject to a large number of locational and environmental influences. These indicators are strongly influenced by seasonal and climatic conditions, lot size, the extent of industrial development and, in the case of water consumption, the implementation of water-saving strategies in some LGAs. This multiplicity of environmental impacts make the data unsuitable for estimating service populations.

b) Desirable Criteria

In assessing the usefulness of each indicator, four desirable criteria were also considered; these were:

1. *Extent of behavioural variation between resident and non-resident populations*

If the indicator hides significant differences in consumption patterns between the resident and non-resident populations, then a rise or fall in the latter will not be reflected by a corresponding rise or fall in consumption.

The difference in the newspaper-buying behaviour of residents and tourists provides a good example. Although newspaper sales show a marked increase in some tourist destinations during peak holiday periods, a large percentage of visitors, who normally purchase newspapers when at home, apparently fail to do so when on holiday. For example, in 1998 and 1999, sales of the Saturday edition of the "West Australian" fell significantly in the Perth metropolitan region on certain public holiday weekends, when large numbers of residents travelled to tourist destinations in the surrounding areas. However, the total increase in sales in the ex-metropolitan regions of the State did not match the decrease experienced in Perth.

It is hypothesised that visitors to an area will exhibit different consumption patterns from the usual residents for many items purchased through retail outlets, including petrol, milk, alcohol, bread, cigarettes and Coca-Cola, especially if the duration of the visit is short (say less than one week). Commuters and tourists, for example, may bring food, drink or cigarettes from their place of usual residence, make local purchases of alcohol or soft drink in different-sized containers from usual residents or purchase their petrol in another LGA.

By comparison, patterns of waste production, particularly volumes of wastewater, would appear to be less susceptible to the residential status of the individual.

2. *Variations in consumption patterns between different socio-demographic groups*

For indicators measuring consumption by individuals (as opposed to households or commercial establishments), the ideal indicator is one which measures a variable that is evenly distributed throughout the population of Australia. Once again, indicators of this type are difficult to find although measures of milk and bread consumption would appear to come closer to meeting this criterion than

measures of consumption which are specific to certain sectors of the population such as drivers, cigarette smokers, drinkers of alcohol or users of automatic telling machines. Persons in these categories are typically adult and may have other definitive socio-demographic characteristics.

While it may be statistically possible to estimate a proportional rise or fall in the size of the total service population from a rise or fall in the consumption of petrol or cigarettes, this requires reliable benchmark data as a basis for the calculation. Benchmark data would not be required for indicators where average, or per capita, consumption figures were available for the area in question (see criterion 3 below) and where the indicator variable was evenly distributed through the Australian population.

3. *Availability of per capita consumption/production figures at the appropriate geographic level*

Given reliable per capita consumption/production figures, it is theoretically possible to estimate the size of the service population directly from the total amount of bread or milk consumed, or the total amount of wastewater produced within the LGA. However, such estimations would necessarily be based on a number of broad assumptions including an even distribution of that variable across the Australian population, accurate measurement of the indicator variable at the LGA, level and the negligible influence of locational and environmental factors.

Average, or per capita, consumption figures are not widely available for items 'consumed' by individuals. Milk and alcohol are two commodities for which the relevant State regulatory or licensing authorities can provide total and average consumption data. However, in the case of milk, these data are not available for LGAs in Western Australia while, in the case of alcohol, there is a requirement for reliable benchmark data as consumption is not evenly distributed through the Australian population.

4. *Whether the data can be obtained from a single data source*

For reasons of consistency and ease of access, it is desirable if the indicator data for all LGAs within the State can be extracted from a single source. Data held by State government agencies, or State/national distributors, therefore, are generally preferable to data held by individual LGAs.

Use of data held by the Water Corporation would pose a problem in this regard as some LGAs, including the Busselton study area, have their own water supply.

3.2.2 Summary Evaluation of the Indicators

a) Consumption Indicators

The following table provides a summary of the consumption indicators investigated and a list (not necessarily exhaustive) of the criteria which they failed to meet. Essential criteria are denoted 'E' while desirable criteria are denoted 'D'.

TABLE 1 CONSUMPTION INDICATORS

Indicator	Criteria Not Met
Water consumption	<p>E4 - data not readily accessible</p> <p>E5 - incomplete coverage e.g. bores and rainwater tanks in some LGAs</p> <p>E6 - environmental factors e.g. climate, water-saving strategies, household size, lot size, commercial and industrial usage</p> <p>D4 - some LGAs not supplied by the WA Water Corporation</p>
Power consumption: - gas - electricity	<p>E1 - reticulated gas not available in all LGAs</p> <p>E2 - no LGA level data on electricity in some parts of State</p> <p>E6 - environmental factors e.g. climate, commercial and industrial usage</p> <p>D4 - mining towns not supplied by Western Power</p>
Telephone/ATM usage	<p>E1 - ATMs not available in all LGAs</p> <p>E2 - no LGA level data on telephone usage</p> <p>E5 - incomplete coverage of telephone usage within the LGA due to use of mobile phones</p> <p>D1 - ATM usage may vary between residents and visitors</p> <p>D2 - ATM usage may vary between socio-demographic groups</p>
Sales of: - petrol, - alcohol, - newspapers	<p>E4 - data not readily accessible from regional/national distributors</p> <p>E5 - incomplete coverage due to multiple sales outlets within each LGA</p> <p>D1 - consumption may vary between residents and visitors</p> <p>D2 - consumption may vary between socio-demographic groups</p> <p>D3 - per capita consumption data not available for petrol/newspapers</p> <p>D4 - data for each LGA must be acquired from a number of sources</p>
Sales of - milk, - bread, - Coca Cola, - cigarettes	<p>E2 - no LGA level data available (regional data available for milk)</p> <p>E4 - data not readily accessible from regional/national distributors</p> <p>E5 - incomplete coverage due to multiple sales outlets within each LGA</p> <p>D2 - consumption of Coca-Cola and cigarettes varies between socio-demographic groups</p> <p>D3 - per capita consumption data not available (except for milk)</p> <p>D4 - data for each LGA must be acquired from a number of sources</p>

b) Waste Production Indicators

The following table provides a summary of the waste production indicators investigated and some essential criteria which they failed to meet.

TABLE 2 WASTE PRODUCTION INDICATORS

Indicator	Criteria Not Met
Sewage/Wastewater disposal	E1 - not all LGAs are sewered E5 - incomplete coverage e.g. use of septic tanks in some LGAs E6 - environmental factors e.g. commercial and industrial usage
Garbage/refuse disposal	E1 - refuse amounts only available for some LGAs E5 - incomplete coverage e.g. use of alternative service providers by some commercial establishments E6 - environmental factors e.g. recycling strategies

3.2.3 Generic Indicators: Some Conclusions

All the generic indicators investigated in the course of this study failed to meet some of the essential criteria, the most common problems being lack of applicability to certain LGAs, incomplete coverage of the dataset, difficulties in accessing or extracting the data from sources not designed for the purpose, data not available at the appropriate geographic level, failure to measure consumption at the required geographic level and the impact of environmental variables on consumption patterns.

No generic indicators were identified that could provide service population estimates for all the study areas, or even a majority of LGAs within the State. In general, waste production indicators tended to look more promising than consumption indicators for estimating some service populations, with monthly data being available and accessible from a single data source for selected LGAs.

Where wastewater schemes are in place, flow data are collected monthly and reported annually to the Environmental Protection Authority (EPA) as part of the Water Corporation's Licence reporting requirements. Wastewater flows are used by the Water Corporation to plan for and design sewerage systems. These are based on indicative per capita flow volumes (230 litres per capita per day in the north of Western Australia compared with 180 litres in the south).

Wastewater flows have been used in some jurisdictions, including the Town of Port Hedland, to produce estimates of the service population. However, since factors such as infiltration and the type of services connected (i.e. domestic, commercial or industrial) may distort the figures, a data quality assessment for a range of LGAs would be required before any recommendations could be made regarding the usefulness of this indicator in estimating specified service populations.

Refuse disposal also offers promise in some LGAs as a means of estimating service population size. The EPA can provide monthly data on the weight of refuse received from every LGA in the metropolitan region of Perth, except Serpentine- Jarrahdale, and also from Bunbury and Kalgoorlie-Boulder. The data are collected from landfill operators who weigh each truck entering the site, record the LGA from which it came and whether the truck contains domestic or commercial refuse. However, these data are not available for landfill sites which do not have a weighbridge, this being the situation at most sites outside

the metropolitan region. This means that the data are currently available for only one of the five study areas. Again, in order to assess the feasibility of estimating the service population of the LGA from the weight of refuse produced, it would be necessary to evaluate the quality of the data obtained from a range of LGAs.

Of the consumption indicators, milk consumption, at this stage, would appear to be one of the more promising indicators in terms of its potential to measure the service population in those LGAs which have the resources to collect the necessary data. There are a number of reasons to support this hypothesis. Firstly, milk is a commodity which is consumed by most people, regardless of their location, age, sex or other socio-demographic characteristics. Secondly, patterns of purchase and consumption are unlikely to vary significantly between usual residents and other members of the service population. Thirdly, milk is a commodity for which per capita consumption figures are available on a regional basis from the dairy industry.

A major problem, however, in using retail milk sales as an indicator of service population size is that the data are not available at the LGA level from a single data source. In the majority of cases, the data could only be collected by obtaining regular sales data from all milk outlets within the LGA. Such a procedure would be time-consuming and costly and would require considerable input from the individual LGA. Most importantly, it would be necessary to evaluate the data obtained from a range of LGAs before milk consumption could be recommended as an indicator for widespread use in service population estimation.

3.3 Estimating Components of the Service Population

The approach so far described has relied on identifying and evaluating generic indicators; that is, indicators which can measure change in the total service population, regardless of its component parts, be they permanent or temporary residents or daily visitors. The failure of this approach to identify any widely applicable indicators led the project team to turn its attention to the investigation of data sources which might assist in estimating particular components of the service population within each of the study areas.

This section of the report outlines the major data sources that were investigated in relation to fly-in/fly-out and contract workers, tourists, daytrippers, transient Indigenous people and daily commuters, and provides some conclusions on the sources most likely to produce reliable estimates of these components.

3.3.1 An Overview of Data Sources

a) Fly-in/Fly-out and Short-term Contract Workers

Two of the study areas, Wiluna and Port Hedland, have significant numbers of fly-in/fly-out and contract workers employed directly in the mineral ore extraction or processing industries, or in providing services to those industries.

In the Shire of Wiluna, these workers are employed at four minesites, all of which operate on a fly-in/fly-out basis. In Port Hedland, a relatively small proportion of the contract workforce is directly involved in mineral extraction while a larger proportion is involved in ore processing and transportation and related service industries.

In recent years Port Hedland has experienced a significant increase in its short-term contract workforce, as a result of large-scale construction projects undertaken by the mining industry. After the 1996 Census, when the total workforce of Port Hedland was 5,474 persons, the construction of a BHP Hot Briquette Iron (HBI) plant, a tunnel under the harbour to transport the ore and the upgrading of shiploading facilities, brought up to 3,000 additional (mostly short-term contract) workers into the LGA at the peak of the construction phase.

The data holdings of a number of State government agencies were reviewed in this pilot study, with a view to ascertaining the extent of information held on fly-in/fly-out and contract workers in the two study areas. These agencies included the Department of Minerals and Energy (DOME), the Department of Resource Development (DRD), Worksafe (the agency responsible for promoting occupational health and safety in the workplace) and Workcover (the agency which collects insurance policy and industrial accident data from private insurance companies).

Employment data from a 1998 survey conducted by the Ministry for Planning in the Town of Port Hedland and from the 1996 Census were also analysed,

Department of Minerals and Energy

The DOME accident reporting branch collects monthly data on the total number of company and contract workers employed at all minesites in Western Australia. For the purposes of this study, information was obtained for all minesites operating in the Shire of Wiluna and in the Town of Port Hedland for the period January 1996 to December 1998.

As the very remote Shire of Wiluna has few employees outside the four minesites and all the minesite employees operate on a fly-in/fly-out basis, this dataset appears to provide very accurate estimates of the total number of fly-in/fly-out workers in the LGA at the end of each month, as well as useful information on monthly fluctuations and longer-term trends in employment (see Wiluna Case Study, Appendix B).

However, the DOME accident reporting system is not useful for estimating the contract or fly-in/fly-out workforce of Port Hedland. The LGA has only two minesites, employing about 160 persons, of whom less than 20% are employed on contract (i.e. not permanent employees). Neither of the two minesites employs fly-in/fly-out workers. The two minesite operations account for only a small proportion of the total contract workforce of the Shire, the construction industry (particularly in recent years) accounting for a much larger proportion.

Department of Resource Development

Although its ongoing data holdings are small, DRD holds some employment data for Port Hedland relating to the construction of the HBI Project and the expanded port facilities. These data, obtained from BHP on a monthly basis, were collected to assist in managing the impact of the development projects on the Town, particularly in terms of accommodation and infrastructure needs.

The data show the total number of contract and permanent personnel employed in the construction and operation of BHP facilities between July 1996 and March 1999. The numbers employed rose rapidly from 489 at 31 July 1996 to a peak of 3,517 at 31 March 1998; then, as the construction phase neared completion, dropped back to 1,052 by March 1999. The majority of these workers were on contract, with the permanent operating workforce stabilising at around 240 employees at this time.

While there is no reason to doubt the reliability of the monthly figures as counts of the number of people 'on the ground', their usefulness for estimating the size of the contract workforce of Port Hedland is limited.

Firstly, the employment figures do not include contract workers employed in non-BHP projects. In particular, they do not take account of the increase in the 'flow-on' or 'consequential' workforce which resulted from the various development projects, particularly in the service industries. In planning the Town's infrastructure needs, it was assumed by the DRD consultants in 1996 that there would be a 10% increase in the consequential workforce during the development phase (DRD, 1996). However, no reliable sources of data, to corroborate these workforce projections, have been identified.

A second problem relates to the fact that some of the contract workers were recruited locally by BHP. While a proportion of these local recruits may have been usual residents of the LGA, others would have been temporary residents who had moved to the LGA in anticipation of finding contract work. Hence it is not possible to produce reliable estimates of that component of the BHP contract workforce who were not usual residents.

The usefulness of the DRD dataset in estimating service population components is further limited by the fact that it cannot provide the number of family members accompanying the construction workforce, notwithstanding the increased provision in 'married quarters'.

In the future, the department expects to collect similar data for the Pilbara town of Karratha, where there are plans to construct a large oil and gas project. However, since the data are only collected for relatively short periods in particular areas, they are of limited value in estimating service population components.

WorkSafe/WorkCover

At the present time, neither of these State agencies is able to provide employment data that could be used in estimating the size of the workforce, or any of its components, at the LGA level.

Workplace data are available from both agencies for Workers' Compensation claimants and policy-holders (employers). However, these are the administrative by-product of private insurance companies who are willing to report only limited details. Hence there is no reliable information from these sources on the total number of workers employed at each workplace location.

Ministry for Planning

The Ministry for Planning has conducted a number of Commercial and Industrial Land Use Surveys in the metropolitan and selected regional centres, including the townsite of Port Hedland. Information is collected on the number of employees at each commercial establishment within the regional centre.

As a survey of Port Hedland was conducted in 1998, when the temporary contract workforce was close to its peak, the dataset was investigated with a view to ascertaining its usefulness in estimating the increase in the total workforce of the LGA since the 1996 Census.

The data provided to the ABS did not include establishments that had failed to provide information on the number of persons employed. The Ministry advised that non-response was considerably higher in the survey of Port Hedland (20% or more) than in the metropolitan survey (around 5%).

The Ministry also advised that the dataset did not give complete coverage of commercial/industrial establishments on all land use types; that is, it did not include establishments located on land zoned 'rural', 'residential' or 'public purpose' or on unzoned land. This is problematic in rural and regional centres such as Port Hedland where industrial/commercial activities more frequently occur on land which is not zoned for the purpose.

The dataset therefore lacked the necessary coverage to produce reliable workforce estimates for the Town of Port Hedland.

Australian Bureau of Statistics

The size of the Port Hedland workforce (5,474 persons) at 6 August 1996 is derived from the journey to work data collected in the Census. Detailed analysis of this workforce, in terms of place of employment and usual residence, has been undertaken as part of a broader study of the working population of the Pilbara Statistical Division (Ruthven and Nevill, 1999).

The limitations of the Census arise primarily from the fact that it can provide only a 'snapshot' of the working population of the LGA at a particular point in time. This limitation is particularly apparent in LGAs such as Port Hedland, which have experienced rapid growth since the Census.

While journey to work data were not available for the Shire of Wiluna, the 1996 Census is able to provide some useful information on its working population, including the low propensity of employed persons counted in the Shire, (the majority of these being in single men's quarters), to report the LGA as their usual place of residence (see Wiluna Case Study, Appendix B). This suggests that Census counts based on place of enumeration may provide a better basis for estimating the number of fly-in/fly-out workers than counts based on place of usual residence.

The ABS Business Register was also investigated as a possible source of employment data for businesses located within the study areas.

The Business Register is a database of all businesses in Australia employing wage and salary earners. Its prime purpose is to provide a comprehensive source of business names and addresses from which businesses can be selected for inclusion in ABS economic censuses and surveys. Additional data recorded on the Register includes main economic activity and number of employees.

It was found that, generally speaking, the Business Register does not provide the necessary locational details needed to produce accurate estimates of workforce components. A detailed explanation of the limitations of the Register are provided in Appendix E. In summary, the main limitations arise from problems in attributing employees and contractors to specific locations and the reliability of the sources for updating register information.

b) Tourists

All the study areas, with the exception of Wiluna, have a significant tourist population. Three key agencies, in addition to the ABS, were identified as possible sources of data on tourists in Western Australia: the Bureau of Tourism Research (BTR), the Western Australian Tourist Commission (WATC) and Main Roads, Western Australia. Some agencies within the individual study areas were also approached for information.

Bureau of Tourism Research

The BTR collects a broad range of data through its International and National Visitor Surveys (formerly the Domestic Tourism Monitor) including the destination and origin of travellers, the purpose, seasonality and duration of the trip, types of accommodation and transport used and selected socio-demographic characteristics. Data from these surveys are collected monthly and published on a quarterly basis.

The surveys are designed to provide reliable estimates of the number of domestic and international visitors aged 14 years and over within each State and Territory. They are not designed to provide estimates of the total visitor population. The surveys do not provide much reliable information at the sub-State level. While some data items are available for the 10 broad "tourist regions" within Western Australia, no information is available at the LGA level.

Western Australian Tourist Commission

Until recently, WATC has collected data annually through its Western Australian Travel Survey (WATS). This survey provided data on visitors to the regions but was unable to provide much reliable information at the level of the LGA. Last conducted in 1995-96, the WATS did provide limited information on individual towns within some of the study areas, including numbers of overnight visitors, types of

accommodation used and the proportion of visitors staying with friends or relatives.

Through its Tourist Development Register, the WATC is also able to provide details of all completed tourist developments since 1990, in each of the study areas (except Wiluna) as well as estimates of visitor numbers to major tourist attractions within the State. Although the latter may be useful in confirming peaks and troughs in visitor numbers, such estimates will only account for a portion of the total tourist population.

Main Roads, WA

The Main Roads department can provide road counts from all its permanent and temporary stations around the State, including those positioned on major roads leading into each of the four ex-metropolitan study areas. The data are collected on a daily basis.

Road counts are useful as indicators of daily, weekly, monthly and seasonal fluctuations in visitor numbers. However, they cannot distinguish between local, through and overnight visitor traffic nor between vehicles of different sizes. Since the number of persons in each vehicle is unknown, road counts are of limited value for estimating the number of overnight visitors, especially in such LGAs as Port Hedland and Busselton, which experience a substantial amount of through traffic.

Regional Tourist Authorities/Tourist Bureaux

These local sources of data can provide information on daily visitor numbers to the bureaux themselves or to local tourist attractions. While potentially useful in confirming seasonal peaks and troughs in tourist populations, they are, once again, limited by the fact that they relate to only a small percentage of tourists within the area.

Australian Bureau of Statistics

The ABS Survey of Tourist Accommodation (STA) is the main source of tourist data at the LGA level, providing a possible basis for estimating the tourist component of the service population in some LGAs, as well as information on seasonal fluctuations and longer-term trends.

Recent changes in the scope of the STA mean that it no longer collects, on an ongoing basis, data on caravan parks, holiday flats and houses, or visitor hostels and only includes the larger hotels, motels and guest houses (with 15 or more rooms). Despite these limitations, this survey is still widely regarded as the best source of data on tourist movements. Indeed it is almost the only source of data at the LGA level. In the course of this investigation, the importance of the STA was expressed repeatedly by LGA officials in the study areas, as well as by officers of the various Regional Development Commissions and by the WATC, who use STA data extensively in their own analyses and reports.

Current STA data are expected to produce reasonable estimates of overnight visitors on both a quarterly and annual basis for the City of Perth (see Perth Case Study, Appendix B), and possibly also for other inner city areas containing relatively few private dwellings. In these areas, most overnight visitors could be expected to stay in large hotels, there being little or no opportunity to stay in caravan parks, holiday homes or smaller commercial establishments.

However, in LGAs such as Busselton and Gingin, which contain a large number of small commercial establishments and caravan parks, and where a large proportion of overnight visitors stay in holiday homes and other private dwellings, estimates based entirely on STA data are likely to grossly understate the number of visitors at certain times of the year.

The pilot study identified a further possible use of STA data in estimating the total capacity, or maximum, number of persons that can be accommodated in those (mainly southern) tourist destinations which are reputed to attain 100% occupancy in the height of the summer season. In the proposed model (Appendix C), data from the STA would be used to estimate the total number of overnight visitors to the LGA that can be accommodated in the larger commercial establishments. These data are then supplemented by data from other sources including the number of rateable dwellings in the LGA (from the Valuer-General's Office), the average number of persons per occupied dwelling (from the 1996 Census) and the proportion of dwellings that are unoccupied (assumed to be holiday homes) in the winter 'low' season (also from the Census). By combining data from these various sources, the proposed model would be used to estimate the "total capacity" of the LGA in terms of its ability to accommodate both resident and non-resident populations.

A further refinement of this model (Appendix D) is designed for use in estimating the average number of overnight visitors in a specified period. The application of this technique relies heavily on local knowledge and requires that certain assumptions be made, including the number of days in the specified period when the maximum number of visitors is reached.

It should be noted that these models depend on a number of assumptions about the resident and visitor populations and have limited applicability in the north of the State, where visitor populations tend to peak in winter when the number of unoccupied dwellings is lower than at other times of year. Because the Census occurs in winter, there is no information, for these northern LGAs, on dwelling occupancy rates in summer when the number of tourists is expected to be relatively low.

c) Daytrippers

The daytripper population is likely to be significant in inner city areas such as the City of Perth, which attract large numbers of shoppers and visitors to cultural and entertainment venues from surrounding LGAs. It is also likely to be significant in the Shire of Gingin, especially the coastal towns of Lancelin, Ledge Point, Seabird and Guilderton, all of which are within easy driving distance of the metropolitan area.

To date, no reliable sources of data on daytripper numbers have been identified. Although BTR's and WATC's travel surveys have collected information on day trips, as well as overnight trips, none of this is available at the level of the LGA.

d) Transient Indigenous People

Two of the study areas, the Shire of Wiluna and the Town of Port Hedland, have a significant number of Indigenous people.

A considerable amount of information on Indigenous people is available from the 1996 Census. However, due to the highly mobile nature of some Indigenous people in remote areas, this needs to be updated on a frequent basis. No ongoing sources of data were identified which could provide this information with the required frequency, although more recent data on some Indigenous communities are available from the 1997 WA Environmental Health Survey. The Commonwealth agency Centrelink is also able to provide information on the number of Indigenous persons in some remote communities from the community profiles which it is currently developing.

e) Daily Commuters

The 1996 Census collected information on persons who commuted daily to the City of Perth from adjacent LGAs for employment purposes. No other reliable, or more recent, sources of information were identified in the course of this pilot study. Data sources investigated included the Western Australian Department of Transport and the Ministry for Planning.

Department of Transport

This department undertakes a survey of commuters entering the City by public transport approximately every five years. However, no data which could be used to estimate this component of the service population are collected on a more regular basis.

Information from public transport ticket sales and validating systems is not useful for this purpose, as tickets are issued according to the number of metropolitan 'zones' being crossed and not according to the final destination of the journey.

However, even if information on destinations were available, data on public transport users would need to be supplemented with data on commuters using private vehicles. While the City Council may be able to provide information on the number of cars parked within the city limits each weekday, this would be likely to overstate the number of daily commuters owing to the fact that some visitors to the City would be visiting for non-work purposes.

Ministry for Planning

The Ministry for Planning last conducted its three-yearly Commercial and Industrial Land Use Survey in the City of Perth in 1996. Data from this survey include the number of employees at each commercial establishment within the LGA.

While the 1996 Perth survey could be used to provide 'snapshot' information about the commuter population, it is unlikely to provide more reliable data than the Census undertaken in the same year, given the five per cent non-response rate.

Australian Bureau of Statistics

The Census is likely to remain the most reliable source of data for estimating the size of the commuter population of the City of Perth. The 1996 Census collected workplace destination data for all persons counted in the Perth Statistical Division and surrounding Statistical Local Areas (SLAs). The total workforce of the City of Perth (96,360 persons at 6 August 1996) was derived from these data.

An estimate of the commuter population can be produced by subtracting the number of persons in that workforce who were usual residents of the LGA from the total workforce figure (see Case Study 3: Appendix B). This assumes that the level of misreporting of 'usual residence' status amongst the City of Perth workforce is negligible. However, the estimate of the commuter population derived by this method clearly excludes some members of the commuter population for whom workplace destination was not coded because they were outside the Perth Statistical Division and surrounding SLAs on Census night. It also excludes a relatively small number of persons who were missed in the Census. Across Australia, the 1996 Census missed 1.6% of people who were present in the country on Census night (ABS, 1997).

Another difficulty in using Census data to estimate either the total workforce or the commuter population of the LGA is that the Census is undertaken every five years and the data may quickly become out of date. However, it may be possible to produce annual estimates of the commuter population on the

assumption that the Census undercount of the workforce is small and that increases in the workforce will occur at a constant rate in the current inter-Censal period (1996-2001). These estimates could be derived from the annual average rate of change in the workforce that occurred in the previous inter-Censal period (1991-1996) and the estimated resident population (ERP) at 30 June each year.

3.3.2 Estimating Components: Some Conclusions

Several conclusions can be drawn about estimating service population components.

- For remote LGAs that are dominated by mining workers operating on a fly-in/fly-out basis, the DOME's accident reporting dataset may be a useful source for estimating the fly-in/fly-out component of the service population. Appendix B contains a case study of the Wiluna Shire in which the DOME dataset is used, in conjunction with Census data, to produce experimental estimates of this component. The dataset, however, has limited applicability for LGAs where mining workers constitute a less significant proportion of the total fly-in/fly-out workforce.
- The Wiluna case study suggests that fly-in/fly-out workers in such remote locations have a fairly low propensity to report the LGA in which they work as their usual place of residence. In these circumstances, Census counts based on place of enumeration may provide a better basis on which to estimate the service population of the LGA.
- For inner city areas containing relatively few private dwellings, caravan parks, holiday flats or other small commercial accommodation units, the Survey of Tourist Accommodation is expected to produce reasonable estimates of overnight visitors on both a quarterly and annual basis. Appendix B contains a case study of the City of Perth in which this dataset is used, in conjunction with Census data, to produce experimental estimates of the tourist component.
- Based on certain assumptions about levels of undercounting of the LGA workforce and misreporting of usual resident status, Census data can be used to produce estimates of the commuter population for those urban LGAs where workplace destination information is available. Appendix B contains a case study of the City of Perth using 1996 Census data. Again, if some explicit assumptions about rates of change are acceptable to the user, estimates for inter-Censal years can be derived using data from the two previous Censuses and the latest ERP figures.
- Care should be taken when adding estimates of tourists, fly-in/fly-out workers or commuters to other components of the service population as this may result in some double-counting. For example, in some LGAs, mining companies accommodate their contract staff in hotels and other tourist accommodation. This makes it difficult to add workforce and tourist components, especially where different data sources are used.

4. OUTCOMES

4.1 Major Findings

In the course of this feasibility study, a large number of data sources were investigated. Most were found unsuitable for the task of estimating service populations in the five study areas, or the various components of those populations.

The outcomes from this study may be summarised as follows:

1. Although much information is currently held by State government and other agencies which could assist in the measurement of service populations, the study failed to identify any generic indicators which could be used successfully to estimate a total service population for all five LGAs.
2. Pending further research on the quality of data held by the relevant State agencies and the correlation between these data and population size, refuse and wastewater measures may be useful for producing service population estimates for a limited number of LGAs. The measurement of milk consumption might also prove useful although, due to the multiplicity of data sources, this would present more difficulties for those wishing to acquire the data.
3. Some data sources were identified that, subject to the acceptance of certain explicit assumptions by major stakeholders, could be used to produce estimates for a small component of a total service population, such as tourists and commuters in the inner city area or fly in/fly out workers in an isolated mining community.
4. For certain (mainly southern) LGAs with large tourist populations, there may be some scope to develop estimates of the 'maximum carrying capacity' i.e. the total number of persons (excluding day visitors) that can be accommodated in the LGA if all private dwellings and beds in commercial accommodation establishments are fully occupied. For these LGAs, there may also be scope to develop estimates of the average number of overnight visitors within a specified period.
5. In the future, responsibility for LGA service populations may rest with Local Government Grants Commissions in liaison with the LGAs for which they provide funding. This would require an agreement between State and local governments specifying the data to be used in service population estimation and the steps to be taken in ensuring these data are appropriate, reliable and consistently applied to all LGAs with a similar population profile. The ABS would be willing to assist with this process.

4.2 Possible Areas of Future Investigation

Based on the above outcomes, a number of research areas have been identified which could support further investigation. These relate mainly to data quality issues and fall into three broad avenues of investigation covered by this report: generic indicators; service population components; and maximum and average carrying capacities of specified tourist destinations.

Generic Indicators

Three areas relating to generic indicators were identified for possible future investigation:

- assessment of the quality of data held by the Water Corporation (or equivalent bodies in other States) on wastewater flows from LGAs and analysis of the correlation between these data and population size. This investigation could be undertaken for a range of LGAs where flow data are available and where there is little or no reliance on septic tanks.
- assessment of the quality of data held by the Environmental Protection Authority (or equivalent bodies in other States) on refuse collected from LGAs and analysis of the correlation between these data and population size. This investigation could be undertaken for a range of LGAs which use a single landfill site and have similar methods for collecting refuse and recyclable materials.

- investigation of the feasibility of collecting regular milk consumption data from a range of LGAs, with a view to ascertaining the reliability of the data for service population estimation. The study would require the cooperation of the larger supermarket chains, smaller retail outlets and individual LGAs, which would be responsible for the identification of all sales outlets within their areas of jurisdiction and, in some cases, the direct collection of data from these outlets.

Of these three areas of possible investigation, the last would be the most difficult, time-consuming and costly to undertake. Given the need for negotiation with the larger supermarkets, such a project could only be undertaken under the aegis of a co-ordinating body which could liaise at the State or national level.

Service Population Components

Two possible areas of research were identified relating to service population components:

- investigation of the feasibility of using employment data held by the Department of Minerals and Energy (or equivalent bodies in other States) to estimate the number of fly-in/fly-out workers in remote mining communities other than Wiluna.
- investigation of the feasibility of using data from the ABS Survey of Tourist Accommodation to estimate the number of overnight visitors in a range of LGAs located in inner city areas and other large urban centres.

Maximum and Average Carrying Capacity of Tourist Destinations

Further research in this area would involve an assessment of the coverage and quality of dwelling data held by the Valuer-General's Office (or equivalent bodies in other States). This research would be undertaken with a view to producing experimental estimates of the 'capacity population' and the average overnight visitor population in selected (mainly southern) tourist destinations. Such research would be based on the explicit assumption that estimates of this type would meet the needs of some major stakeholders,

4.3 Summary of Findings

Although the pilot study investigated a large number of data sources, none could be used to produce estimates of the total service population for the broad range of LGAs represented by the five study areas. Some datasets were identified which could be used to estimate components of that population in particular LGAs.

The avenues of research outlined above hold some promise for producing estimates for certain types of LGA. However, before any particular avenue of research could be pursued, the existence of a comparable dataset within each State/Territory would need to be established. In addition, each State/Territory would need to identify LGAs within its boundaries which conformed to the profile required for the specific area of investigation. For example, to assess the quality of wastewater flow data, the State would need to identify a number of LGAs for which flow data were available and which had little or no reliance on septic tanks. Similarly, the production of estimates of fly-in/fly-out, or contract, workers from mining employment data would require the identification of some remote LGAs where such workers were the dominant group.

In order to produce comparable statistics, a consistent approach is required at the State, and preferably national, level. Developing such an approach would require a source of funds as well as support from the relevant government and non-government agencies.

REFERENCES

Australian Bureau of Statistics [1996a] *Review of Demography Statistics 1996*, Demography Working Paper 96/2

Australian Bureau of Statistics [1996b] *1996 Census Dictionary*, Catalogue No. 2901.0.

Australian Bureau of Statistics [1997] *Information Paper: Census of Population and Housing: Data Quality - Undercount, 1996*, Catalogue No. 2940.0.

Australian Bureau of Statistics [1999] *Population by Age and Sex, Western Australia, 30 June 1998*, Catalogue No. 3235.5.

Bell, M.J. and Ward, G.J. [1998a] Patterns of Temporary Mobility in Australia: Evidence from the 1991 Census, *Australian Geographical Studies*, March 1998.

Bell, M.J. and Ward, G.J. [1998b] Which Population?, *Australian Planner*, Vol 35, No.1, 1998.

Bell, M.J. and Ward, G.J. [1998c] Who are the visitors? Measuring circulation in Australia, paper presented to the 1998 Biennial Conference of the Australian Population Association

Bell, M.J. and Ward, G.J. [1999] The Geography of Temporary Mobility in Australia, paper presented to the 1999 Biennial Conference of the Population Association of New Zealand.

Cook, T. [1997] *When ERPs Aren't Enough - A Discussion of Issues Associated with Service Population Estimation*, Australian Bureau of Statistics Demography Working Paper 96/4.

Cook, T. [1998] Overnight Visitor Counts in Australia and their Implications for Population Estimation, *People and Place*, Vol 6, No. 1

Department of Resource Development [1996] Town of Port Hedland Accommodation Study, unpublished report

Ruthven, P. and Nevill, R. [1999] *Workforce of the Pilbara Statistical Division: An Analysis of Place of Employment and Usual Residence*, Australian Bureau of Statistics Census Working Paper.

APPENDIX A: DATA SOURCES

NON-ABS SOURCES

Australian Dairy Corporation
Australian Electoral Commission
Dairy Industry Authority of WA
Bureau of Tourism Research
Busselton Water Board
Cape Naturaliste Tourism Association
Centrelink
City of Perth
Department of Commerce and Trade
Department of Industry, Science and Resources - Petroleum Division
Department of Land Administration
Department of Minerals and Energy
Department of Resource Development
Department of State Revenue
Department of Transport
Environmental Protection Authority, Western Australia
Main Roads Western Australia
Ministry for Planning
Office of Water Regulation
Shire of Busselton
Shire of Gingin
Shire of Wiluna
Southern Regional Tourism Association
South West Chamber of Commerce and Industry
South West Development Commission
Telstra
Town of Port Hedland
Valuer-General's Office
Water Corporation
Western Australian Newspapers
Western Australian Police Service
Western Australian Tourism Commission
Western Power
WorkSafe, Western Australia
WorkCover, Western Australia

ABS SOURCES

1996 Census of Population and Housing
1997 WA Environmental Health Survey
ABS Business Register
Survey of Tourist Accommodation, 1991-1997

APPENDIX B: ESTIMATING COMPONENTS OF SERVICE POPULATIONS - CASE STUDIES

Case Study 1: Fly-in/Fly-out Workers in the Shire of Wiluna

Analysis of Census Data

Of the 1879 persons enumerated in the Shire of Wiluna on Census night, 75% (1442 persons) were enumerated in non-private dwellings, the majority (1407) being accommodated in staff quarters. It can be assumed that most, if not all, these occupants of staff quarters were associated with the mining industry. More than half (712) regarded themselves as non-usual residents.

Furthermore, of the 1,105 people in Australia who described themselves as usual residents of Wiluna, only 72 were counted outside the Shire on Census night. This number seems extremely small since, on any particular night, it could be expected that approximately one third of minesite employees would be off-duty and therefore outside the LGA.

The above analysis of Census data suggests that place of enumeration counts are a better basis for analysis of the Wiluna workforce than usual residence counts.

Although it might be expected that the total number of employed persons in the Shire would be higher than the number accommodated in staff quarters, only 1,132 persons counted in Wiluna reported that they were employed. This appears to be mainly due to the large number of people (404) in staff quarters who failed to report their employment status. However, their presence in staff quarters would suggest that almost all would have been employed. This assumption is supported by the following analysis which shows the employment status of the remaining 1003 occupants of staff quarters. Table 3 indicates that only 55 persons (less than 6% of those reporting their employment status) were in the 'not employed' category, eight of these being overseas visitors and five being under 15 years of age.

TABLE 3 SHIRE OF WILUNA: SELECTED CHARACTERISTICS(a)

Total Persons	1,879
- Persons in Staff Quarters	1,407
- Overseas visitors	8
- Aged under 15 years	5
- Aged 15 years and over	1,394
- Employed	948
- Unemployed	21
- Not in the labour force	21
- Employment status not stated	404
- Persons in private dwellings	437
- Overseas visitors	12
- Aged under 15 years	102
- Aged 15 years and over	323
- Employed	170
- Unemployed	3
- Not in the labour force	138
- Employment status not stated	12

(a) Based on Place of Enumeration. Source: ABS, 1996 Census of Population and Housing

If it is assumed that 94% of persons in staff quarters who did not report their employment status were employed, this would add another 380 persons to the number of employed persons counted in Wiluna on Census night, bringing the total to 1512. The true figure may be even higher if, as seems likely, some employed persons in staff quarters misreported their employment status as 'unemployed' or 'not in the labour force'.

The above adjustment brings the Census figure considerably closer to the number of minesite employees estimated to be in Wiluna in August 1996 by the Department of Minerals and Energy (DOME).

Analysis of the DOME Dataset

The DOME dataset indicates that there were 1789 persons working at the four Wiluna minesites (Mt Keith, Jundee, Nimary and Wiluna Mine) on the last day of August 1996.

The department has indicated that all persons employed at the Wiluna minesites are employed on a fly-in/fly-out basis, whether company or contract employees. The following table, which is based on monthly data obtained from the DOME's accident reporting branch, shows that the average number of employees varied between 1511 persons in 1996 and 1928 persons in 1998. The majority of these employees (around 70%) were employed on a contract basis.

TABLE 4 AVERAGE NUMBER OF EMPLOYEES, WILUNA MINES 1996-98(a)

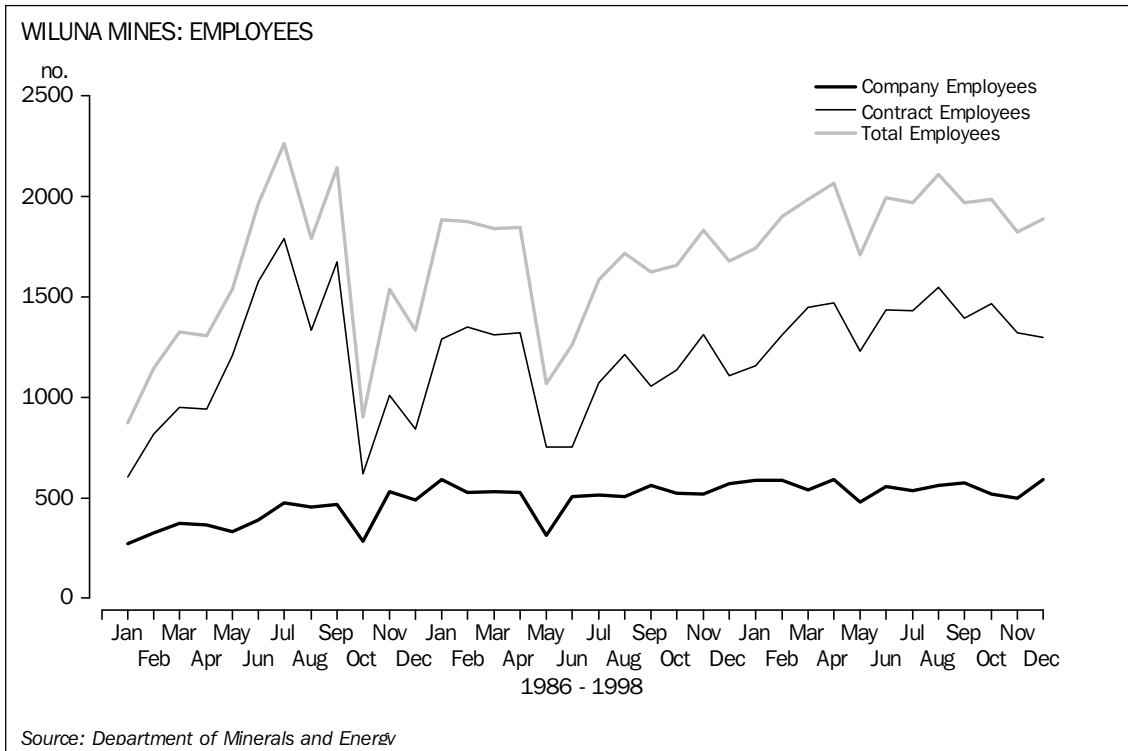
Year	Company Employees	Contract Employees	Total Employees
1,996	397	1,114	1,511
1,997	516	1,141	1,656
1,998	552	1,376	1,928

(a) Based on all employees at the minesites on the last day of each month.
Source: Department of Minerals and Energy

Although it may be concluded from Table 4 that there has been a gradual increase in the number of minesite workers in Wiluna since 1996, the yearly averages do, in fact, hide considerable monthly variation in the number of employees, as the following graph clearly illustrates. This variation was most apparent in 1996 when both the lowest (Jan - 876 employees) and highest (July- 2264 employees) monthly figures were recorded. This variation appears to be mainly attributable to changing weather conditions, with heavy rains causing the open cut mines to flood and shut down on a number of occasions.

In conclusion, for remote LGAs such as Wiluna which are dominated by mining workers who operate on a rotational basis, the DOME's accident reporting dataset may be a useful source of data for estimating the fly-in/fly-out component of the service population. However, care would have to be taken in adding this component to other service population components, given the very real possibility of duplication.

In addition, the fairly low propensity of fly-in/fly-out workers to report the LGA in which they work as their usual residence means that Census counts based on place of enumeration, rather than place of usual residence, are probably a better basis on which to estimate the total service population of the LGA.



Case Study 2: Tourists in the City of Perth

Analysis of Data from the Survey of Tourist Accommodation, 1991 - 1997

As most of the guest accommodation available in the City of Perth is provided by large commercial establishments (exclusively hotels) with 15 or more rooms, the ABS quarterly Survey of Tourist Accommodation (STA) can be expected to produce reasonable estimates of overnight visitors.

The number of hotels in the City area has been fairly consistent since March 1991, when 31 of these establishments were recorded. The number fell to 27 in the September 1994 quarter, but reached 31 again by the September 1997 quarter. The number of available guest rooms followed a similar pattern, falling from 4255 in March 1991 to 3711 in December and rising again to 4424 in December 1997.

In the City of Perth, the peaks and troughs in the tourist population do not appear to follow the pronounced seasonal patterns which are found in the north and south-west of the State. However, overnight visitor numbers do increase in the summer months. Table 5 shows that Perth hotels usually have the highest occupancy in the December quarter and the lowest occupancy in the winter (June quarter). Over a seven year period, the average nightly number of guests in the December quarter ranged from 4545 to 5134 whereas in the June quarter the range was 3630 to 4672. The annual average in the same seven year period ranged from 4219 to 4654 persons.

TABLE 5 PERTH CITY TOURIST ACCOMMODATION: SELECTED CHARACTERISTICS

Perth City: Hotels, motels and guest houses						
	Establishments	Guest rooms	Bed Spaces	Guest nights ('000)	Average Nightly No. of Guests	
					Per quarter	Per annum
1991						
March	31	4255	10162	355.9	3954	
June	31	4249	10168	348.2	3826	
September	30	4170	9201	395.2	4296	
December	30	4166	9325	440.5	4788	4219
1992						
March	31	4244	9577	386.6	4248	
June	31	4245	9569	330.3	3630	
September	31	4245	9589	394.5	4288	
December	31	4159	10138	443.5	4821	4248
1993						
March	31	4164	10042	400.0	4444	
June	31	4249	10312	380.9	4186	
September	31	4249	10286	436.0	4739	
December	31	4256	10276	472.3	5134	4628
1994						
March	31	4252	10297	444.1	4934	
June	31	4247	10307	425.2	4672	
September	27	3714	8606	399.4	4341	
December	27	3711	8572	430.9	4684	4654
1995						
March	28	3755	8739	400.5	4450	
June	28	3754	8749	370.3	4069	
September	28	3754	8751	381.1	4142	
December	28	3758	8774	418.1	4545	4301
1996						
March	27	3698	8662	390.9	4296	
June	28	3852	9081	347.6	3820	
September	28	3888	9181	389.0	4228	
December	30	4446	10255	440.4	4787	4284
1997						
March	30	4424	10231	395.3	4392	
June	30	4405	10185	363.7	3997	
September	31	4401	10238	388.9	4227	
December	31	4424	10503	442.7	4812	4358

Source: ABS Survey of Tourist Accommodation

The STA figures for the 1996 September quarter are comparable with those obtained from the 1996 Census. The STA shows the average nightly number of guests in the September quarter was 4288 while the number of people staying in Perth hotels on Census night (6 August) was 4060.

Case Study 3: Commuters in the City of Perth

Analysis of Census Data

In the City of Perth, the daily commuter population is by far the largest component of the service population. Journey to work data from the Census shows the total workforce of the LGA to be 96,360 in 1996 (Table 6). Of this workforce, only one per cent (966 persons) were usual residents of the LGA. An estimate of the commuter population might be produced by subtracting this number of usual residents from the total workforce. The main difficulty with this derived estimate (95,394 persons) is that it excludes some members of the commuter population for whom workplace destination was not coded because they were outside the Perth Statistical Division and surrounding SLAs on Census night. It may also exclude a small number of workers who were missed in the Census.

TABLE 6 WORKFORCE OF PERTH CITY: PLACE OF USUAL RESIDENCE

Workplace, City of Perth	Place of Enumeration			Total
	Perth (C)	Remainder Perth SD	Remainder WA	
Place of Usual Residence				
Perth (C)	937	23	6	966
Perth SD Remainder	47	93384	344	93775
Remainder WA	43	413	1053	1509
Elsewhere in Australia	18	88	4	110
Total	1045	93908	1407	96360

Source: ABS, 1996 Census of Population and Housing

Another difficulty in using Census data to estimate either the total workforce or the commuter population of the LGA is that the Census is undertaken every five years and the data may quickly become out of date. However, it may be possible to produce reasonable annual estimates of the commuter population based on the following assumptions:

- that the 1996 Census undercount of the workforce was negligible; and that
- increases in the workforce are occurring at a constant rate in the current inter-Censal period (1996-2001).

If these assumptions are acceptable to users, annual estimates of the commuter population could be derived using the annual average rate of change in the workforce that occurred in the previous inter-Censal period (1991-1996) and the estimated resident population (ERP) at 30 June each year, as prepared by the ABS.

Adding Components of the Service Population

While it may be possible to estimate some of the individual components of the service population using different sources of data, any attempt to produce a total service population (at say August 1996) would be subject to the following potential problems:

- underestimation of one or more of the components (e.g. the workforce population derived from the Census is known to exclude people who were outside the area on Census night);
- double-counting of persons who are included in two or more of the components; and
- exclusion of entire components, which have been overlooked or are too difficult to estimate. (For example, adding estimates of the commuter, tourist and usual resident components for the City of Perth would not produce a 'total' service population as the significant daytripper component would be excluded).

APPENDIX C: ESTIMATING 'CAPACITY POPULATIONS' IN TOURIST DESTINATIONS

The following is a proposed model for estimating the total 'carrying capacity' of those (mainly southern) tourist destinations which are characterised by a large proportion of unoccupied holiday homes in the winter (ie Census) period. It outlines a possible method for estimating the maximum number of persons that can be accommodated in both private and commercial accommodation. It does not provide a measure of the actual number of persons in the LGA at any given point in time.

This model is only applicable where there is anecdotal or other evidence to suggest that occupancy of private and commercial accommodation reaches capacity in the summer holiday season. The Shires of Busselton and Gingin both fit this LGA profile, with 24% and 51% respectively of private dwellings being unoccupied at the time of the Census but (anecdotally) reaching 100% occupancy in the summer school holidays. In LGAs such as these, it is not possible to estimate the tourist component of the service population using the Survey of Tourist Accommodation (STA) alone, as that survey does not include visitors who stay in private dwellings and smaller commercial establishments.

The process outlined below offers an alternative approach which may be of some value to LGAs interested in estimating the maximum number of persons (excluding daytrippers) for which they are required to provide services. The process could be undertaken by LGAs which keep up-to-date records of all rateable properties (both private and commercial) within their jurisdiction, including the number of rooms or bed spaces (as appropriate). However, property listings from the Valuer- General's Office (VGO) may provide an alternative source of data. Additional or supplementary sources include the STA, the Tourist Development Register and RAC Accommodation Guides.

Given reliable data sources, the steps involved in estimating the carrying capacity of the LGA are quite straightforward:

1. Estimate the total visitor capacity (bed spaces) in tourist accommodation establishments using STA data, local rating information and other sources as required.
2. Multiply the current number of private dwellings (obtained from local rating or VGO data sources) by the average number of persons per occupied dwelling (obtained from the Census) to produce an estimate of the maximum number of persons accommodated in private dwellings.
3. Add the estimates from steps 1 and 2 to produce the total capacity (resident + non-resident) population.

Limitations of the model

The proposed model has a number of limitations:

- it assumes the average number of persons per dwelling remains constant even in peak periods;
- it does not take account of visitors who stay in private dwellings with family members or friends (ie with usual residents of the LGA) or as bed and breakfast guests in non-registered private dwellings (however, there is no known data source from which that portion of the visitor population can be calculated);
- it may overstate that portion of the visitor population who stay in the larger, "registered" commercial establishments as, even in peak periods, some beds are probably vacant;
- it may understate visitors staying in caravan parks and camping grounds (for whom reliable data are difficult to collect); and

- it requires reliable data sources which are kept up to date and which give good coverage of all types of accommodation.

To date, there has been no attempt to produce estimates using this model. Further research into the feasibility of producing estimates would require:

- acceptance by the various Grants Commissions and other major stakeholders of the conceptual and methodological limitations of the model, and the implicit and explicit assumptions on which it is based;
- recognition by the stakeholders of the value and applicability of this model to a range of LGAs (mainly tourist areas in the southern half of the continent);
- further resources to investigate the quality of dwelling data held by individual LGAs and the VGO (and equivalent agencies in other states).

APPENDIX D: ESTIMATING AVERAGE NUMBER OF OVERNIGHT VISITORS IN TOURIST DESTINATIONS

The following proposed model builds on the concept of the "capacity population" and is only applicable to tourist destinations with the profile described in Appendix C.

It has a further requirement that a reasonable estimate can be made of the number of days in the year when the capacity population is reached. This requirement assumes some local knowledge of the 'peaks' and 'troughs' in the visitor population which can be confirmed using indicators such as hotel bookings, road traffic and tourist bureaux counts, or visitor counts to particular tourist attractions or events.

The model aims to produce estimates of the average overnight tourist population in a specified period (eg the January to March quarter) and requires the following steps to be taken:

1. Estimate the number of nights in the specified period when the capacity population is reached.
2. Multiply the total number of dwellings unoccupied at the time of the Census by the average number of persons per occupied dwelling (also obtained from the Census).
3. Estimate the total number of visitor nights for "unoccupied" dwellings by multiplying the estimates in steps 1 and 2 above.
4. Estimate the maximum number of guest nights in the specified period for commercial accommodation (based on bed spaces) or use data on 'guest nights' from the Survey of Tourist Accommodation.
5. Add the estimates from steps 3 and 4 to obtain the total number of visitor nights in the specified period for both commercial and private accommodation.
6. Divide by the number of days in the period to obtain the average number of visitors per day.

Limitations of the model

The proposed model has a number of limitations, including:

- it is not applicable to "northern " tourist destinations where the maximum visitor population is likely to be reached in winter (ie Census time) and there are no data available on the number of unoccupied dwellings in the 'low season' ;
- it assumes that the number of persons per dwelling is the same for "holiday homes" as for other dwellings; and
- it requires local knowledge and a variety of data sources.

As with the model for estimating capacity populations, there has been no attempt to trial this model as further investigative work would require:

- acceptance by the various Grants Commission and other major stakeholders of the conceptual and methodological limitations of the model and the implicit and explicit assumptions on which it is based;
- recognition by the stakeholders of the value and applicability of the model to a range of LGAs (mainly tourist areas in the southern half of the continent).

APPENDIX E: THE ABS BUSINESS REGISTER

The ABS Business Register was investigated as a possible source of employment data for businesses located in the study areas.

The ABS Business Register is a database of all businesses in Australia employing wage and salary earners. The prime purpose of the ABS Business Register is to provide a comprehensive source of business names and addresses from which businesses can be selected for inclusion in ABS economic censuses and surveys.

In addition to business names and addresses, data recorded on the Register for each business include items such as main economic activity and employment size. With the exceptions noted below for some locations, employment and industry details are recorded on the Register for both "Management Units" (the largest units within a business for which detailed quarterly accounts are kept) and for "Locations" (the physical sites from which a business engages in productive activity on a relatively permanent basis e.g. shop, factory or suite of offices in a multi-occupancy building). All Locations on the Register are allocated to Statistical Local Areas (SLAs), which equate to LGAs or can be aggregated to form LGAs. The employment figure excludes unpaid workers and persons sub-contracted to a business.

Locations recorded on the ABS Business Register are physical sites from which a business engages in productive activity on a relatively permanent basis. This has impact on the usefulness of the data in the estimation of service populations. Some activities are carried out by a mobile workforce, for example travelling sales representatives, timber cutters, truck drivers, construction workers and so on. In general these workers are attributed to a location which is their relatively permanent base of operations and in some cases may be the head office of the business.

Many different sources are used to update information on the ABS Business Register, and updating is done on a continuous basis. New employing businesses are identified using Group Employer Registration information from the Australian Taxation Office (ATO) and included on the Register within one to six months of commencing employment of staff. Details of businesses which have ceased employing are now being received from the ATO and are being used to update the Register.

However, there has been no reliable source for updating business location information, particularly where businesses have expanded to additional locations or ceased to operate in some locations. Similarly, while the quality of industry and employment data for new businesses is generally good, the accuracy of these data at the location level tends to degrade over time as units change their activity and employment levels. Because of the nature of the register and the timeliness problems which may occur, Business Register statistics should be seen as broad indicative data at a point in time, rather than precise measures.

Within the ABS there have been some recent changes in procedures associated with the recording of businesses on the Business Register. The necessity for recording comprehensive location detail, as a register maintenance strategy, has all but disappeared with the introduction of new strategies that are no longer reliant on name and address matching. For the largest businesses which are personally profiled, it is no longer mandatory that all individual locations in particular industries be recorded on the Business Register. While this is a recent introduction to work practices, it is likely to have increasing impact on the suitability of the Business Register to provide employment data for small areas. The industries currently affected by this change to procedures are listed below:

ANZSIC Group 732 - Deposit taking financiers (covers Banks, Building societies, Credit unions etc)

ANZSIC Group 811- Government Administration (covers Commonwealth, State and Local Government administration)

ANZSIC Groups 841 and 842 - Preschool and School Education (covers Preschools, Primary, Secondary and Special schools, but excludes Post School Education)

ANZSIC Group 861 - Hospitals and Nursing Homes

ANZSIC Group 872 - Community Care Services (covers Accommodation for the aged etc)

ANZSIC Subdivision 92 - Libraries, Museums and the Arts (also covers Parks and gardens)

ANZSIC Group 963 - Public Order and Safety Services (covers Police, Corrective Services, Fire Brigade and Waste Disposal Services)

ANZSIC Group 620 - Rail Transport

ANZSIC Division J - Communication Services (covers Postal, Courier and Telecommunication Services)

The current Business Register, therefore, is unsuitable for estimating components of the working population, particularly where time series data are required.

**APPENDIX F: WHEN ERPs AREN'T ENOUGH - a discussion of issues associated with service population estimation (Executive Summary),
Cook, T, Australian Bureau of Statistics Demography Working paper 96/4**

1. This paper reports on user needs and the conceptual, methodological and reporting load issues involved in estimating service populations. It has been prepared in response to the Australian Bureau of Statistics (ABS) 1996 Review of Demography Statistics, with the intention that the paper will promote discussion about the issues raised within.
2. The term service populations refers to those persons who demand goods or services from providers of such commodities. Such persons may be permanent or temporary residents of the area from which the service is sought, or they may be daytime visitors (including commuters), overnight or short-term visitors to the area.
3. Nearly 40 percent of agencies which responded to the 1996 Demography Review specified that estimates of resident populations (ERPs), as currently prepared by the ABS, do not meet their population needs since services can also be demanded by persons not resident to an area.
4. It is not surprising that the Review concluded that support for service population estimation is strong and widespread given the expansion of the service industry sector over the past twenty years (as measured by employment growth). Such support is also consistent with informal comments made by a variety of population users, especially over the last decade, about limitations associated with ERPs.
5. Whilst population estimates based on place of 'usual residence' are conceptually sound and are favoured over 'place of enumeration' estimates by many international statistical agencies, the relevance of 'usual residence' based estimates to some users is limited by the level of population mobility hidden within these estimates. Concerned users are therefore seeking a supplementary series of population estimates to ERPs.
6. Arguably the most significant issue associated with service population estimation is the lack of uniformity between service providers and the products they deliver. Such diversity makes the topic of service populations complex. Specifically, considerable variability exists in the demographic and geographic characteristics of the target populations to which different services are intended.
7. In generalised terms, however, service populations can be defined as consisting of resident populations (or parts thereof) and or non-resident populations (or parts thereof) for a defined geographic area. This generalised definition illustrates that service providers' needs are likely to be better served if components of resident and non-resident populations can be estimated separately.
8. The types of non-resident populations of interest to service providers includes commuter populations, daytrippers, tourists and other overnight visitors (for one or many nights) and a diverse range of temporary residents (e.g. seasonal employees such as fruit pickers; cyclical employees such as fly-in/fly-out mine workers; winter-time visitors to sunbelt zones and residents of Aboriginal outstations in the dry season).
9. It is anticipated that the service population needs of some service providers will be so specific as to have little or no generic applicability to others (for example, persons demanding particular health care services). Identification of such service populations is likely to be possible only by use of datasets which relate specifically to provision of those services, such as associated administrative datasets. By contrast, the needs of a variety of service providers are expected to be assisted if users can gain access to a range of non-resident population estimates which have been prepared from generic datasets.

10. Access to generic non-resident population estimates is expected to assist in the creation of user specific service population definitions, by allowing individual users to combine none, some, or all of the component non-resident population estimates with resident population estimates (ERPs) (or parts thereof).

11. Thus adoption of a component approach to non-resident population estimation could maximise the possibility of users' diverse needs being met. Furthermore, a component approach would allow estimation of specific types of non-resident populations to commence once data sources, which meet user requirements, are identified without need to wait until data for all types of non-resident populations are identified. In general terms, a component approach offers the advantage of allowing non-resident population types to be estimated in accordance with a range of priorities, including timeliness, data access, user demand and cost considerations.

12. The success of generic estimates will, however, depend on how closely data definitions associated with such estimates can meet individual user requirements. Some user needs, for example, are expected to allow for data definitions which do not strictly observe the statistical classification principle of mutual exclusivity. In practical terms, this could be very important as use of existing data sources may make it difficult to create data definitions for a variety of non-resident population types which are mutually exclusive.

13. A brief description of existing datasets which may prove useful in preparing generic non-resident population estimates is provided in Appendix A. Use of existing data sources to prepare estimates of non-resident populations has a number of advantages over development of new data collections, including immediate access to data (possibly even time series data), lack of duplication of effort, reduced respondent burden and reduced collection costs. But such advantages are tempered by the ability of existing data definitions to meet users needs.

14. Thus the data definitions associated with specific datasets (especially in relation to time, purpose-of-movement, length of stay and geographic criteria) would need to be assessed in accordance with a variety of users' needs to ascertain the value of preparing generic non-resident population estimates.

15. While geographic issues which relate specifically to service population estimates would need to be addressed as part of data definitional considerations, many of the geographic needs of service population users are also expected to be assessed as part of the new standard spatial boundaries being developed in response to the current ABS Review of the Australian Standard Geographical Classification (ASGC). The benefits of the ASGC boundary revisions will not be available to service population estimates before their intended introduction in mid 1998, with their actual implementation expected to be staggered across specific ABS collections.

16. Frequency of estimation issues, in terms of user needs and data quality considerations, also impact on non-resident population estimation. In particular, seasonality is expected to be complicated because mobility patterns are likely to vary for different types of non-resident populations. For example, seasons could range from being eight hourly divisions of a 24 hour period for commuter populations to weekly (or monthly) divisions of a year for itinerant agricultural workers.

17. Costs associated with preparing service population estimates are expected to be considerable even if data from existing data sources are used. In particular, gaining access to a variety of datasets (possibly managed by a number of agencies) and extracting and maintaining data from such datasets, are expected to involve a substantial commitment in terms of human and computing resources.

18. Preparation of service population estimates which meet specific user needs (either for an individual or a variety of population users) require that factors such as purpose of use, quality, feasibility and cost be discussed and agreed on by the estimation agency and the client.

19. This research paper has been prepared to assist such discussions.